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DRIVE OVER CONVEYOR PIT ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates generally to movement of grain, and more specifically to, an apparatus and method for movement of grain for transportation and storage.

Common fixtures for storing grain include grain silos and grain bins. Once the grain is harvested, the grain is moved from the field to the grain bin in a truck or hopper bottom trailer. The most common auger configuration includes a main auger positioned at an incline, attached to the hitch of a tractor at the lower end and the upper end discharging into the grain storage fixture. Along with the main auger, another shorter auger is attached to a swing away hopper that is positioned behind the truck or under the hopper bottom trailer. A discharge end of the short auger is attached at an inlet of the main auger. However the swing away hoppers have some disadvantages. For example, some known swing away hoppers require the wheels of the bottom hopper trailer to pass by, then the hopper and short auger combination is manually positioned under the hopper bottom trailer. In such a configuration, there can be a number of iterations of trailer, hopper and auger movement before positioning is correct to begin movement of grain from the trailer to the grain silo or bin.

Some drive over conveyor pits which incorporate frame and ramp assemblies are known. However these drive over pits have a disadvantage in that manual adjustment is required to raise and lower the frame and ramp assembly with respect to the ground. Another major disadvantage is that some drive over conveyor pits require an additional tractor or transport vehicle to move the pit from one location to another. One vehicle for the main incline auger and another for the drive over pit.

BRIEF SUMMARY OF THE INVENTION

In one embodiment, a drive over conveyor pit is provided which comprises a mainframe which further comprises a grain pit located between and adjacent to a plurality of drive over sections. The drive over conveyor pit further comprises a plurality of entrance ramps pivotably attached to a first end of each of the drive over sections and a plurality of exit ramps pivotably attached to a second end of each of the drive over sections. Further, a hydraulic front lift assembly is attached to a front of the mainframe, and a hydraulic rear lift assembly is attached to a rear of the mainframe.

In another embodiment, a hydraulic lift assembly for a drive over conveyor pit is provided. The assembly comprises a plurality of axle frames configured to be pivotably mounted to the drive over conveyor pit and a plurality of caster wheel forks configured to be rotatably mounted to the axle frames, one caster wheels fork per axle frame. The assembly further comprises a plurality of tires configured to be mounted to the caster wheel forks and a hydraulic piston system comprising at least one hydraulic piston. The system is attached to the axle frames and configured to cause the drive over conveyor pit to be raised and lowered through extension and retraction of the piston, extension and retraction of the piston causing the axle frames to pivot at the mounting to the pit.

In still another embodiment a grain transfer system is provided which comprises a drive over conveyor pit and a grain auger. The grain auger includes a feed chute. The drive over conveyor pit comprises a mainframe comprising a grain pit located between and adjacent to a plurality of drive over sections, entrance and exit ramps pivotably attached to the drive over sections, a transition housing attached to a front of the mainframe and configured for mechanical attachment to the feed chute. The drive over conveyor pit comprises a hydraulic front lift assembly attached to the transition housing and a hydraulic rear lift assembly attached to a rear of the mainframe.

In yet another embodiment, a grain transfer system comprises a drive over conveyor pit and a grain auger comprising a feed chute. The drive over pit comprises a grain pit located between and adjacent to a plurality of drive over sections and entrance and exit ramps pivotably attached to the drive over sections. The grain transfer system further comprises a mechanical linkage intermediate the auger and a discharge end of the feed chute. The feed chute is mechanically attached to the drive over conveyor pit and the mechanical linkage is configured to raise the feed chute and the drive over conveyor pit above a portion of the grain auger for transport.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partially assembled view of a drive over conveyor pit.

Figure 2 is an exploded view of a front lift assembly.

Figure 3 is a perspective view of a portion of the front lift assembly of Figure 2 in a extended position.

Figure 4 is a perspective view of the portion of the front lift assembly of Figure 2 in a retracted position.

Figure 5 is a perspective view of a rear lift assembly.

Figure 6 is a perspective view of a drive over conveyor pit in a lowered position.

Figure 7 is a rear view of a grain transfer system.

Figure 8 is a view of the grain transfer system of Figure 7 in an operating position at a grain bin.

Figure 9 is a view of another grain transfer system.

Figure 10 is a view of the grain transfer system of Figure 9 showing a drive over conveyor pit positioned above a portion of a grain auger.

Figure 11 is a view illustrating operation of mechanical linkage in regard to movement of a drive over conveyor pit.

Figure 12 is a side view of a drive over conveyor pit illustrating a hitching mechanism.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a partially assembled view of one embodiment of a drive over conveyor pit 10. Pit 10 includes a mainframe 12 which includes a grain pit 14 located between and adjacent to drive over sections 16. A pair of entrance ramps 18 are pivotably attached to a first end 20 of each of drive over sections 16. A pair of exit ramps 22 are pivotably attached to a second end 24 of each of drive over sections 16.

At a front end 26 of mainframe 12, a transition housing 28 is attached. A hydraulic front lift assembly 30 (hydraulics not shown in Figure 1) is attached to transition housing 28. A hydraulic rear lift assembly 32 is attached to a rear end 34 of mainframe 12. Transport braces 36 are configured to attach to and retain ramps 18 and 22 in a lifted position for transport.

Figure 2 is an exploded view of front lift assembly 30, transition housing 28 and mainframe front 26. Transition housing 28 is configured to be connected with mainframe front 26 through flanges 50. In one embodiment, transition housing 28 is bolted to mainframe 26. In an alternative embodiment, transition housing 28 is welded to mainframe 26.

Front lift assembly 30 is attached to transition housing 28 and includes a right axle frame 60, a caster wheel fork 62, and a tire 64. Assembly 30 further includes a left axle frame 66, a caster wheel fork 62, and a tire 64. Right axle frame 60 and left axle frame 66 are attached to transition housing 28, in one embodiment, using pivot pins 68 which are inserted through a sleeve 70 located on a first end of axle subframe 84 and an attachment member on an end of each of right axle frame 60 and left axle frame 66. Tires 64 are attached to wheel forks 62 as known in the art.

Caster wheel forks 62 include a mounting pin 74 which is inserted into a sleeve 76 at an end of axle frames 60 and 66 opposite the end which includes sleeve 70. Pin 74 and sleeve 76 form a freely rotating, or pivoting, coupling. Pin 68 and sleeve 70 and attachment member 72 also from a pivoting coupling. The two couplings allow mainframe 12 to be lowered to the ground and tires 64 to be lifted and moved away from mainframe 12 using hydraulics as explained below. Connection of transition housing 28 to mainframe front 26 aligns housing plate 78 with grain feed holes 80. When drive over conveyor pit 10 is in operation, grain is fed through feed holes 80 and into an auger (not shown), whose feeding mechanism attaches to housing plate 78 and under a semi circular recess 82 of axle subframe 84. Wheel assemblies other than caster wheel fork 62 are contemplated.

Figure 3 is a perspective view of a portion of front lift assembly 30 in an extended position. Figure 4 is a perspective view of the portion of front lift assembly 30 in a retracted position. Components in Figures 3 and 4, identical to components shown in Figure 2 are identified in Figures 3 and 4 using the same reference numerals used in Figure 2. Figure 3 illustrates that in a raised position, sleeves 76 are positioned perpendicularly to the ground. In such a position, caster wheel forks 62 and tires 64 are positioned for ground contact, and in conjunction with the aforementioned hydraulics, cause mainframe 12 to be lifted for transport.

Alternatively, and referring to Figure 4, front lift assembly 30 is shown in a retracted position. To assume the retracted position, the hydraulics cause axle frames 60 and 66 to pivot at pin 68 and sleeve 70. Further, axle frames 60 and 66 are configured such that, as they pivot, sleeves 76 begin to move from a perpendicular position, and mainframe 12 (shown in Figure 1) begins to be lowered to the ground. Once mainframe assumes ground contact, axle frames 60 and 66 continue to pivot, based upon the travel of the hydraulic system used, to a point where sleeves 76 are at an angle between perpendicular and horizontal. In one embodiment, the angle from perpendicular is about 40 degrees, thereby causing tires 64 to raise from the ground.

The above is reversed when moving from a retracted position to an extended position. The hydraulics cause axle frames 60 and 66 to again pivot at pin

68 and sleeve 70. As axle frames 60 and 66 pivot, sleeves 76 begin to move from the angular position towards the perpendicular position, causing tires 64 to come into ground contact, which, based upon the configuration of axle frames 60 and 66 causes a lifting of mainframe 12 (shown in Figure 1) from the ground. Axle frames 60 and 66 continue to pivot, based upon the travel of the hydraulic system used, to a point where sleeves 76 are perpendicular to the ground and mainframe 12 is in a fully raised position, ready for transport.

Figure 5 is a perspective view of rear lift assembly 90. Assembly 90 includes a tire 92 to which is connected a caster wheel fork 94. Caster wheel fork 94 is attached to an axle frame 96 using a pin 98 and sleeve 100 assembly to provide a freely rotating coupling. Axle frame 96 is pivotably connected to rear end 34 of mainframe 12 through an attachment member 102, which in one embodiment, is non-movably attached to rear end 34 of mainframe 12. In one embodiment, attachment member 102 is welded to rear end 34 of mainframe 12. In an alternative embodiment, attachment member 102 is molded as part of rear end 34 of mainframe 12. In still another alternative embodiment, Attachment member 102 is configured with a flange which is bolted to rear end 34 of mainframe 12.

Axle frame 96 is pivotably attached to attachment member 102 through any of a variety of attachment means as known in the art. In the embodiment shown, a plurality of holes 104 in an end portion 106 of attachment member 102, and a plurality of holes 108 in an end portion 110 of axle frame 96, are configured to align as end portion 106 of attachment member 102 is slidably engaged with end portion 110 of axle frame 96. An attachment means, for example, a pin, extends through aligned holes 104 and 108 to secure attachment member 102 to axle frame 96. In the embodiment, the pin is held in place, for example, with cotter pins, or clips attached to the pin. In an alternative embodiment, the pin is configured with a flange on one end, and a second end is retained using the cotter pin or clip.

Axle frames 60, 66, and 96, in one specific embodiment, are configured for attachment to hydraulically driven pistons (not shown in Figures 1, 2, or 5). When the pistons are in an extended position, axle frames 60, 66, and 96 are

forced into a position such that mainframe 12 is lift from the ground, thereby enabling transport. By retracting the pistons, axle frames 60, 66, and 96 are forced to pivot with respect to axle subframe 84 and attachment member 102, thereby allowing mainframe 12 to lower to the ground for an intended usage. Once mainframe 12 comes into contact with the ground, the pivoting of axle frames 60, 66, and 96 continues, thereby causing tires 64, and 92 to be raised and positioned out of the way of grain truck operators and other users. Those skilled in the art will appreciate that other embodiments of hydraulically driven piston arrangements are possible, including a single piston for both of front axle frames 60 and 66. Alternatively, hydraulics are also configurable such that extending the piston causes mainframe 12 to be lowered and retraction of pistons cause tires 64 and 92 to come into ground contact thereby lifting mainframe 12 for transport.

Figure 6 is a perspective view of one embodiment of a drive over conveyor pit 130 in a lowered position. Components in Figure 6, identical to components shown in Figures 1, 2, or 5 are identified in Figure 6 using the same reference numerals used in those Figures. Pit 130, in the embodiment shown, includes a front hydraulic piston 132 which is configured to cause front lift assembly 30 to operate as above described for raising and lowering at least a portion of mainframe 12. A rear hydraulic piston 134 is configured cause rear lift assembly 90 to operate as above described, also for raising and lowering at least a portion of mainframe 12. Hydraulic connections to, for example, a hydraulic drive system of a tractor, is not shown.

Referring to front lift assembly 30 as shown in Figure 6, it is appreciated that axle frames 60 and 66 are configured to raise tires 64 in both a vertical and forward direction. Such a configuration allows pit 130, more specifically, front lift assembly 30, to assume a lower profile when in position for intended use (e.g. lowered). A connection from transition housing 28 to a feed chute 140, for example, a mechanical connection to a power take-off of a tractor, is also shown. Feed chute 140 is also configured to mechanically attach to a main conveyor (shown

in Figure 8) of a grain auger to move grain from pit 14 through chute 140 to the grain auger for final disposition of the grain.

Attachment of feed chute 140 to a grain auger further provides a means for transport of pit 130 as shown in Figure 7. Figure 7 is a rear view depicting simultaneous transport of a grain auger 200 and drive over conveyor pit 130 using a single tractor 210 or other vehicle, providing a user with a grain transfer system. A telescoping track bar 202 is attached between pit 130 and a frame member 204 of auger 200. Track bar 202 allows pit 130 to travel substantially parallel to and alongside auger 200. Such a towing arrangement provides a convenience to a user as additional mechanical connections between grain auger 200 and feed chute 140 of drive over pit 130 at tractor 210 are the same connections as used when transferring grain. As used herein, the term grain auger, includes, but is not limited to, screw-type augers, belt conveyors, chain conveyors and other implements which are configured for the transfer of grain as described herein with respect to grain auger 200.

Configuration of pit 130 with front lift assembly 30 (shown in Figure 2), rear lift assembly 90 (shown in Figure 5), and transition housing 28 (shown in Figure 1) provides means for towing pit 130 while connected to grain auger 200. Further, pit 130 can be towed without having to configure pit 130 with a trailer hitching arrangement as in known drive over conveyor pits. Still further, pit 130, incorporating lift assemblies 30 and 90, and configurable for towing while mechanically connected to grain auger, provides a user with a safe transport arrangement, as the pit 130 and grain auger 200 combination is only slightly wider than typical tractors and vehicles used for towing such devices.

Figure 8 is a view of the grain transfer system in an operating position at a grain bin 230. Telescoping track bar 202 (shown in Figure 7) has been removed and auger 200 and drive over conveyor pit 10 are positioned for use. A trailer (not shown) which has a load of grain is able to approach and drive over ramps 18 and ramps 22 and position the bottom hopper (not shown) of the trailer over grain pit 14. Also shown are wheels 62 and 92 raised and pivoted away from mainframe 12, allowing the trailer to pass unobstructed.

Figure 9 illustrates another embodiment of a grain auger system 300. System 300 includes a driver over pit 301 and a grain auger 200. Pit 301 further includes a mechanical linkage 302 utilized to raise drive over pit 301 above a portion of grain auger 200 for transport. Mechanical linkage 302 is operated, in one embodiment, by a hydraulic cylinder 304 between a discharge end 308 of feed chute 140 of grain auger 200 and pit 301. Mechanical linkage 302 is mechanically connected to feed chute 140 with a connecting strap 310, which helps to enable movement of pit 301 to a position above auger 200. In one embodiment, hydraulic cylinder 304 is actuated by a tractor hydraulic system (not shown).

Referring to Figure 10, mechanical linkage 302 is attached to auger 200 utilizing a pivot pin 312 connected at a first end 313 of linkage 302. Operation of hydraulic cylinder 304 with, for example, a tractor hydraulic system, causes a second end 314 of linkage 302 to move in a circular arc, causing either a raising of pit 10 to a position above a portion of auger 200 for transport, or a lowering of pit 10 to an operating position. Wheel 316 is attached to pit 301 at an end opposite feed chute 140 and mechanical linkage 302 for assistance with such movement. Drive over conveyor pit 301 is shown in a fully raised position on top of grain auger 200. In one embodiment, a latch mechanism 318 is used to secure pit 301 on top of auger 200 for road transport. In one specific embodiment, latch mechanism 318 includes a pin 319 which is inserted through openings in each of mainframe 12 and auger 200.

Figure 11 further illustrates operation of mechanical linkage 302 as drive over conveyor pit 301 is shown in a partially raised position. Linkage 302, when operated upon by hydraulic cylinder 304, serves to lift feed chute 140, and consequently a portion of drive over conveyor pit 301 over auger 200. Another portion of pit 301 rests on wheel assembly 316, which rolls toward auger 200 as mechanical linkage 302 continues to travel in the circular arc. As mechanical linkage 302 completes travel, pit 301 assumes a position substantially parallel to an auger conveyor 320 of auger 200, and is ready for transport.

Figure 12 is a side view of drive over conveyor pit 301 illustrating a hitching mechanism 340. Hitching mechanism 340 is mechanically attached to pit

301 at the end opposite feed chute 140 (not shown in Figure 12). Hitching mechanism 340 is configured to attach to a towing vehicle, for example, a three point hitch of a tractor, and thereby enables transport of both pit 301 and auger 200 utilizing a single tow vehicle.

The incorporation of hydraulics to raise and lower mainframe 12 of drive over conveyor pits provides a simple to use drive over grain movement solution without the drawback of tire removal or jacking as in some known drive over conveyor pits, and without the manual positioning as required in other known swing auger hoppers. Further, the hydraulics incorporated in the drive over conveyor pit provide an easy setup between transport position and operating position in a short period of time. While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.